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Departamento de Economía
Universidad Carlos III de Madrid
Calle Madrid, 126
28903 Getafe (Spain)
Fax (34) 91 624 98 75

IMPORT TARIFFS, QUALITY INVESTMENT AND WELFARE *

Roberto Hernan[1] y Praveen Kujal[2]

Abstract

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***Acknowledgements**: Kujal acknowledges financial support from grant MCYT BAC2002-03715. +Universidad Carlos III de Madrid, Departament of Economics, Calle Madrid 126, 28903 Getafe, SPAIN. Kujal: Tel. +(34) 91 624 9651, email: kujal@eco.uc3m.es.

[1] Roberto Hernan, Universidad Europea de Madrid, C/ Tajo s/n. 28670 Villaviciosa de Odón, Madrid, SPAIN. E-mail: Roberto.Hernan@uem.es
[2] Praveen Kujal, Universidad Carlos III de Madrid, Departament of Economics, Calle Madrid 126, 28903 Getafe, SPAIN. E-mail: kujal@eco.uc3m.es

Quality Investment and Welfare in the presence of Discriminatory and Uniform Import Tariffs

Roberto Hernán* and Praveen Kujal*+

February 2, 2006

Abstract

In this paper we study incentives for a government to impose a discriminatory or uniform import tariff on its low and high quality imports. In comparison to free trade both tariffs decrease total welfare. In response to any tariff, firms decrease quality investment and total output sold declines. The degree of product differentiation under both the tariffs increases. Consumer surplus declines by a greater amount than the increase in revenues under an import tariff. While the uniform tariff works to the advantage of the high quality firm, the discriminative tariff works to the advantage of the low quality firm. Total welfare, though lower than under free trade, is greater under a uniform than under a discriminatory tariff.

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*Both authors would like to thank Klaus Desmet for useful commentss. Kujal acknolwedges financial support from grant MCYT BAC2002-03715. * Universidad Europea de Madrid, roberto.hernan@uem.es. + Universidad Carlos III de Madrid. Corresponding author: Kujal, Departamento de Economía, Calle Madrid 126, Getafe 28903, Madrid, SPAIN. kujal@eco.uc3m.es.

1 Introduction

Many countries discriminate in tariffs on the basis of the quality of the good. For example, in many countries higher quality goods face a higher tariff rate than comparable lower quality goods[1]. It is clear that models that ignore the quality dimension cannot take into account the tariffs we mention above, i.e. quality justified tariffs. In this paper we model import tariffs for a country that imports a high, and low, quality good. Allowing for the possibility that firm investment in quality is long run, we show that import tariffs are welfare decreasing. Our result is obtained from the effect of decreased quality investment on consumer welfare, an aspect ignored in horizontally differentiated goods industry models. Taking the quality dimension into account our paper lends support to the WTO initiative for the elimination of tariffs. In this sense our paper provides an economic rationale for WTO rules that suggest a gradual decrease of tariffs to zero. That is, total welfare is always greater under zero tariffs[2].

In our model quality investment is a long run variable[3] that allows firms to commit to quality levels before governments fix tariffs. An importing government chooses its tariffs *after* firms invest in quality. Ex-post tariffs are time consistent as firms correctly anticipate tariffs choosing quality accordingly. In this sense firms act as Stackelberg leaders influencing the government choice of the import tariff[4]. We show that, an ex-post import tariff, uniform or discriminatory, is welfare decreasing for a country when quality is endogenously chosen. Firms anticipate tariffs and strategically change their investment in quality. If domestic consumers have increasing willingness to pay for quality, then the importing government finds to its benefit if firms increase quality investment. The import tariff, however, achieves an effect opposite to the goal of the government. In response to the tariff the quality of the imported goods goes down. The resulting decrease in consumer surplus is of a greater magnitude than the increase in tariff revenues. Domestic welfare thus goes down under an import tariff.

The majority of the literature has studied import tariffs using models of imperfect competition where firms produce homogenous goods. They have studied how import tariffs impact welfare for a pure importing country (Brander and Spencer, 1984), or what are the welfare implications of granting a MFN status (Gatsios (1990), Hwang and Mai (1991), Moraga-Gonzalez and Viaene (2002)). Brander and Spencer (1984) show that, in a third market model where two firms sell a homogenous good and compete in quantities, an importing country has incentives to establish an import tariff and that it is welfare improving. In this case the decrease in consumer surplus is more than compensated by the increase in firm profits and tariff revenues. Their model, however, does not allow for the possibility of firms investing in long run variables, such as quality. Several authors (Feenstra (1988), Greenaway et al. (1995), Anderton (1999)) have shown that the volume of trade in such markets is important. It thus seems reasonable that one studies the implications of import tariffs in these industries. Further, these models differentiate between short run (price and output) and long run variables (capacity, quality, R&D etc.). From some recent papers we know that including long run variables can have important effects on final outcomes (Goldberg (1995), Herguera, Kujal and Petrakis (2000, 2002)[5], Moraga-Gonzalez and

[1] For example, higher horsepower cars pay higher import tariffs in many importing countries. For further information on tariff application by countries, see http://www.ustr.gov.

[2] Our result is along the line of the well known result of a welfare decline for a small country imposing an import tariff. We, however, obtain the same result in an oligopolistic model.

[3] See Goldberg (1995), Herguera, Kujal and Petrakis (2000,2002), Moraga-Gonzalez and Viaene (2002).

[4] This would not be true in the ex-ante game as the tariff is rendered ex-post sub-optimal.

[5] Herguera, Kujal and Petrakis (2002) study an import tariff for a country that imports a high, or low, quality good. In their structure they cannot compare welfare effects of a uniform, or discriminatory, tariff.

Viaene (2002), Zhou, Spencer and Vertinsky (2002)).

Independently of the type of the tariff an import tariff always reduces domestic welfare. Firms anticipate government policy and the impact of the tariff on its profits. A fall in profits due to the import tariff results in decreased investment in quality. Product differentiation under both tariffs increases. Prices fall, however, relative to the increase in tariff revenues, consumer surplus declines by a greater amount due to the fall in quality. This decline results in lower domestic welfare. Our results show that including variables such as quality (that positively impact consumer surplus) can have an important effect on results obtained.

The paper is structured as follows. Section 2 is the model under free trade. In Section 3 we discuss uniform and discriminative tariffs. Section 4 concludes.

2 The model

We study a vertically differentiated industry where a high and low quality firm export to a third market. There is no domestic consumption in the exporting countries. The third country is a pure consumer of the imported goods and has no domestic production. Consumers are uniformly distributed in the importing country and are identified by their taste parameter θ, which is distributed uniformly over the interval $\left[0,\overline{\theta}\right]$, with $\overline{\theta} > 0$. Each consumer has unitary demand for the good. A consumer with parameter θ obtains utility $U = \theta s - p$, if he purchases one unit of the good with quality s, at price p. Utility is zero if a consumer does not purchase the good. Note that θ can also be interpreted as the marginal rate of substitution between income and quality ratio (Tirole, 1989, p. 96).

The high and low quality firm compete in quantities. In the first stage firms invest in quality which is then taken as given in the quantity competition stage. In this sense quality is a long run decision variable. Firms first choose quality and then compete in quantities. The marginal cost of production, c, is constant and is independent of costs of quality. The marginal cost of production is set equal to zero without loss of generality. Quality costs are fixed and costs of quality improvement are increasing. This specification captures the characteristics of a (pure) vertical product differentiation model. Shaked and Sutton (1983) define a purely vertically differentiated industry as one in which the costs of quality improvement fall primarily into fixed costs and involve only a modest, or no, increase in unit variable costs. Quality costs borne in the first stage are treated as sunk in the market competition stage. For reasons of tractability we assume that quality costs are quadratic, $s^2/2$. Then, firm i's profits are, $\pi_i = p_i q_i - \frac{s_i^2}{2}$. We solve the game using subgame perfection.

2.1 Quantity competition

We first determine the demand function faced by the firms. Let θ_{HL} be the taste parameter of the consumer that is indifferent between purchasing the high (H), or low (L), quality good. Setting, $\theta_{HL}s_H - p_H = \theta_{HL}s_L - p_L$, we can then write $\theta_{HL} = \frac{p_H - p_L}{s_H - s_L}$. Similarly, we define θ_{L0} as the taste parameter of the consumer that is indifferent between purchasing the low quality good and not purchasing at all. Setting, $\theta_{L0}s_L - p_L = 0$, we then get $\theta_{L0} = \frac{p_L}{s_L}$. Given θ_{HL} and θ_{L0} we can now determine the demand that each

firm faces.

$$q_H^d = \overline{\theta} - \theta_{HL} = \overline{\theta} - \frac{p_H - p_L}{s_H - s_L} \tag{1a}$$

$$q_L^d = \theta_{HL} - \theta_{L0} = \frac{p_H - p_L}{s_H - s_L} - \frac{p_L}{s_L} \tag{1b}$$

where, q_H^d is the demand faced by the high quality firm and q_L^d is the demand faced by the low quality firm. Rearranging, we obtain the indirect demands:

$$p_H = s_H\left(\overline{\theta} - q_H\right) - s_L q_L \tag{2a}$$

$$p_L = s_L\left(\overline{\theta} - q_H - q_L\right) \tag{2b}$$

In the first stage, firms maximize profits with respect to quantities, $\max_{q_i} \pi_i$. The first order conditions for both the firms are $\frac{\partial \Pi_H}{\partial q_H} = s_H\left(\overline{\theta} - 2q_H\right) - q_L s_L$ and $\frac{\partial \Pi_L}{\partial q_L} = s_L\left(\overline{\theta} - q_H\right) - 2q_L s_L$. The equilibrium quantities obtained from solving the first order conditions are given by:

$$q_H = \frac{\left(2s_H - s_L\right)\overline{\theta}}{4s_H - s_L} \tag{3a}$$

$$q_L = \frac{s_H \overline{\theta}}{4s_H - s_L} \tag{3b}$$

Given quantities [3a] and [3b] firms choose qualities in the first stage. Maximizing profits with respect to qualities gives us the first order conditions:

$$s_H = \overline{\theta}^2 \frac{16s_H^3 - 12s_H^2 s_L + 4s_H s_L^2 - s_L^3}{\left(4s_H - s_L\right)^3} \tag{4a}$$

$$s_L = \overline{\theta}^2 \frac{s_H^2\left(4s_H + s_L\right)}{\left(4s_H - s_L\right)^3} \tag{4b}$$

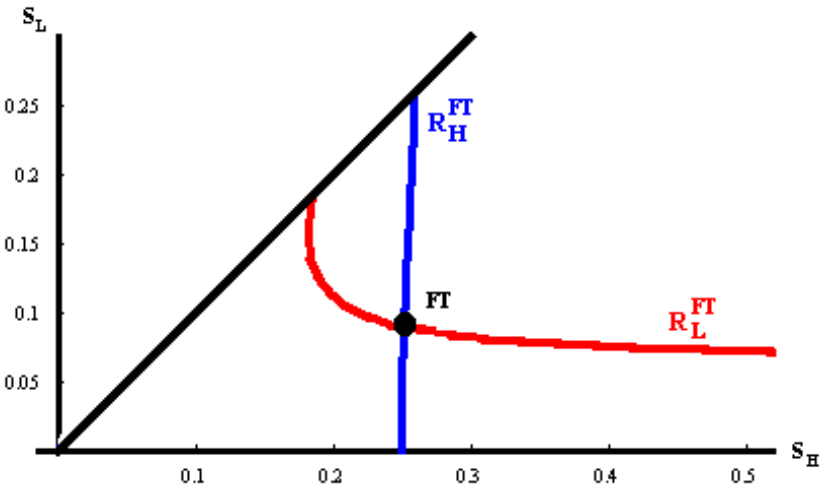

Figure 1: Quality reaction functions under free trade (for $\overline{\theta} = 1$).

The quality reaction functions [4a] and [4b] are described in the figure *1.* The intersection of the reaction function correspond to the Nash equilibrium in quality choices: $s_H^* = 0.2519\overline{\theta}^2$ and $s_L^* = 0.0902\overline{\theta}^2$. Given qualities, one can then write the prices, quantities and profits[6] (see **??**):

$s_H^{FT} = 0.251942\overline{\theta}^2$	$s_L^{FT} = 0.090223\overline{\theta}^2$	$q_H^{FT} = 0.450834\overline{\theta}$	$q_L^{FT} = 0.274583\overline{\theta}$
$p_H^{FT} = 0.1133584\overline{\theta}^3$	$p_L^{FT} = 0.024774\overline{\theta}^3$	$\Pi_H^{FT} = 0.01947\overline{\theta}^4$	$\Pi_L^{FT} = 0.002732\overline{\theta}^4$

Table 1: Equilibrium values under free trade.

Consumer surplus, CS, is defined by the sum of the consumer surplus of the high, $CS_H = \int_{\theta_{HL}}^{\overline{\theta}} (\theta s_H - p_H) d\theta$, and low quality buyers, $CS_L = \int_{\theta_{L0}}^{\theta_{HL}} (\theta s_L - p_L) d\theta$, i.e.:

$$CS = \frac{q_H \left(s_H q_H + 2 s_L q_L \right)}{2} + \frac{s_L q_L^2}{2} \tag{5}$$

In the absence of domestic firms total welfare is equal to the consumer surplus. Substituting the optimal quality, output and price in table **??**, we obtain total welfare (=consumer surplus), $TW^{FT} = CS^{FT} = 0.040174\overline{\theta}^4$.

3 Import tariffs

Brander and Spencer (1984) study the trade policy of an importing country facing a Cournot oligopoly. Studying specific ad-valorem tariffs they show that the optimal tariff leads to higher welfare independently of the number of firms. As in Brander and Spencer we focus on the import policy of a consuming country with no domestic production. We show that an import tariff imposed by a non-producing import country is welfare decreasing. This result emphasizes the importance of studying the effect of trade policy instruments on long run variables such as quality and the important effect they can have on welfare[7]. The direct positive effect of tariff revenues in this can be counteracted by the indirect effect the tariff has on qualities.

In this section we introduce the possibility that an importing country imposes tariffs on its imports. The imported goods are of high, and low, quality. Our simple framework allows us to study the effect of an import tariff on quality. We show that an importing country lowers domestic welfare if it imposes import tariffs. Exporting firms, anticipating the import tariff, invest less in quality. The quality of the imported goods, as a result, declines. This decline in quality lowers consumer surplus. The decline in consumer surplus is greater than tariff revenues and results in a welfare decline for the importing country. Even though tariff revenues are positive, an import tariff can be welfare decreasing due to the fall in the quality of imports. The effect of trade policy instruments on long run variables can give dramatically different results.

The sequence of moves that we consider is the following. In the first stage firms invest in quality. Given the quality investment the government chooses welfare maximizing import tariffs. Given tariffs and qualities firms compete in quantities in the last stage (see *figure* 2).

[6] These are the values that one obtains in the free trade model (see Motta, (1993)).

[7] Herguera, Kujal and Petrakis (2002) show that an importing country with a single domestic firm may be more agressive in its trade policies (tariffs) if the domestic firm is low quality. In this case, profit shifting is greater from an agressive policy.

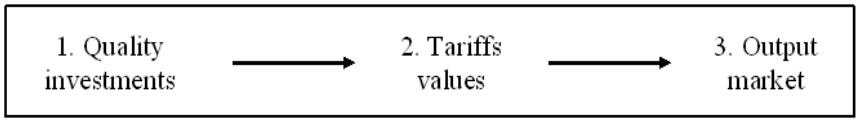

Figure 2: Game stages

In this section we study import tariffs, uniform or discriminative, on both the imported goods. Facing such an import tariff firm profits are, $\pi_i = p_i q_i - t_i q_i - \frac{s_i^2}{2}$, $i = H, L$. In the last stage, firms choose quantities maximizing profits, $\max_{q_i} \pi_i$, $i = H, L$. The first order conditions, $\frac{\partial \Pi_H}{\partial q_H} = s_H\left(\overline{\theta} - 2q_H\right) - q_L s_L - t_H$ and $\frac{\partial \Pi_L}{\partial q_L} = s_L\left(\overline{\theta} - q_H\right) - 2q_L s_L - t_L$, give us the following optimal quantities:

$$q_H = \frac{(2s_H - s_L)\,\overline{\theta} - 2t_H + t_L}{4s_H - s_L} \tag{6a}$$

$$q_L = \frac{s_H s_L \overline{\theta} + t_H s_L - 2t_L s_H}{s_L\,(4s_H - s_L)} \tag{6b}$$

It can be seen from equations [6a] and [6b] that quantities are decreasing (increasing) in own (other) tariffs.

Total domestic welfare is now defined as the sum of the consumer surplus, equation [5], and tariff revenues, $R = t_H q_H + t_L q_L$, that is, $TW = CS + R$. Substituting equations [6a] and [6b] we obtain total welfare.

$$TW = \frac{s_H s_L\left(\left(4s_H^2 + s_H s_L - s_L^2\right)\overline{\theta}^2 - 8t_H t_L + 2\left(\left(4s_H - 3s_L\right)t_H + s_L t_L\right)\overline{\theta}\right) - \left(12s_H - s_L\right)\left(s_L t_H\left(t_H - 2t_L\right) + s_H t_L^2\right)}{2s_L\left(4s_H - s_L\right)^2} \tag{7}$$

We study the possibility that the importing government sets tariffs on both the high and the low quality good. In this case the government has two choices, it can either set a uniform, or discriminatory, tariff on both the goods. We show that a uniform tariff is welfare improving compared to the discriminative tariff. Welfare under the uniform tariff is lower than under free trade. The single uniform tariff, being higher than the discriminatory *low-quality tariff*, has a greater effect on the low quality firm (than the high quality firm). As a result profits for the low quality firm decline more resulting in lower quality investment. Meanwhile, the high quality firm also invests less in quality. Due to the fall in both the qualities, consumer surplus declines and this decline is of a higher magnitude than the import tariff revenues. This results in a decline in overall welfare under the uniform tariff.

The story under a discriminatory tariff is slightly different. In this case the low quality firm invests more in quality than under the uniform tariff thus earning greater profits. The high quality firm, however, faces a very high tariff and invests much less in quality earning less than under the uniform tariff. The decline in quality is greater, resulting in a greater decline in consumer surplus (relative to the uniform tariff). This decline in consumer surplus is greater than observed under the uniform tariff and dominates the increase in tariff revenues. Total welfare as a result declines relative to the uniform tariff and free trade. One of the interesting results emerging out of this section is that tariff policies increasing in qualities are welfare decreasing[8].

[8] This contrasts with the fact that most government policies tax the high quality good more than a lower quality good.

3.1 Uniform tariff

The government sets a uniform tariff, $t\,(=t_H=t_L)$, on all of its imports maximizing total welfare (equation [7]), $\max_t TW$. From the first order condition, $\frac{\partial TW}{\partial t}=\frac{2s_Hs_L(2s_H-s_L)\overline{\theta}-\left(12s_H^2-5s_Hs_L+s_L^2\right)t}{s_L(4s_H-s_L)^2}$, we obtain the welfare maximizing import tariff.

$$t=\frac{2s_Hs_L\left(2s_H-s_L\right)\overline{\theta}}{12s_H^2-5s_Hs_L+s_L^2} \tag{8}$$

We can compute the qualities chosen in the first stage by substituting [8] in the profit functions, $\arg\max_{s_i}\pi_i$, $i=H,L$. The first order conditions from each maximization problem gives us:

$$s_H = \frac{\left(432s_H^6-540s_H^5s_L+336s_H^4s_L^2-185s_H^3s_L^3+75s_H^2s_L^4-15s_Hs_L^5+s_L^6\right)\overline{\theta}^2}{\left(12s_H^2-5s_Hs_L+s_L^2\right)^3} \tag{9a}$$

$$s_L = \frac{s_H^2\left(12s_H^4+53s_H^3s_L+33s_H^2s_L^2-9s_Hs_L^3-s_L^4\right)\overline{\theta}^2}{\left(12s_H^2-5s_Hs_L+s_L^2\right)^3} \tag{9b}$$

One can see in the *figure 3* that the import tariff shifts the reaction functions towards the origin. Both firms reduce quality investment. The shift in the low quality reaction function is greater than the shift in the high quality reaction function. The low quality firm as a result invests much less in quality. On the other hand, the shift of the high quality reaction function is much smaller. The quality decline for the high quality firm is much less. Profits for the high quality firm are greater than under free trade as the uniform tariff impacts the low quality firm negatively making it less competitive. This increases the competitive advantage of the high quality firm increasing its profits.

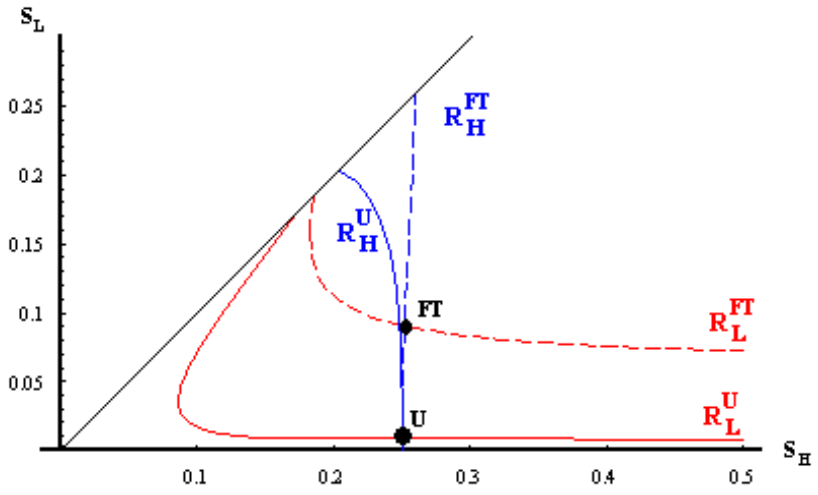

Figure 3: Uniform tariff: Quality reaction functions (for $\overline{\theta}=1$).

Solving equations [9a] and [9b] we obtain the optimal qualities. Substituting these in the quantity, price and profit functions we obtain the results shown in table **??**.

Substituting the optimal qualities in [8], we obtain the welfare maximizing uniform tariff set by the government, $t^U=0.002767\overline{\theta}^3$. Total revenues obtained by the government are $R^U=0.001606\overline{\theta}^4$.

$s_H^U = 0.250001\overline{\theta}^2$	$s_L^U = 0.008327\overline{\theta}^2$	$q_H^U = 0.493011\overline{\theta}$	$q_L^U = 0.087312\overline{\theta}$
$p_H^U = 0.126021\overline{\theta}^3$	$p_L^U = 0.003494\overline{\theta}^3$	$\Pi_H^U = 0.029515\overline{\theta}^4$	$\Pi_L^U = 0.000029\overline{\theta}^4$

Table 2: Equilibrium values under a uniform import tariff.

Consumer surplus for the high, and low, quality consumers is $CS_H^U = 0.030741\overline{\theta}^4$and $CS_L^U = 0.000032\overline{\theta}^4$, respectively. Total welfare under the uniform tariff is $TW^U = 0.032379\overline{\theta}^4$.

Both the firms decrease quality investment. The uniform tariff is worse for the low quality firm. It decreases quality investment by a greater amount relative to the high quality firm. Output sold by the low quality firm falls due to the decline in its quality. The high quality firm also decreases its quality investment but, in a smaller proportion than its rival. The tariff increases product differentiation due to the greater quality decrease by the low quality firm. Due to increased product differentiation the high quality firm makes greater profits, selling more output than it did under free trade. Compared with free trade, total welfare declines under the uniform tariff.

Proposition 1 *Total welfare under an uniform import tariff,* $TW^U = 0.032379\overline{\theta}^4$, *is smaller than under free trade,* $TW^{FT} = 0.040174\overline{\theta}^4$. *Total output and consumer surplus decline under the uniform tariff.*

3.2 Discriminatory tariffs

In this section we allow the importing government to set a discriminatory tariff on the low, and high, quality firm. The domestic government then maximizes total welfare over the high, and, low quality tariff, $\max_{t_H,t_L} TW$.

The first order condition for this optimization problem are $\frac{\partial TW}{\partial t_H} = \frac{s_H(4s_H-3s_L)\overline{\theta}-(12s_H-s_L)t_H+(8s_H-s_L)t_L}{(4s_H-s_L)^2}$ and $\frac{\partial TW}{\partial t_L} = \frac{s_H s_L^2\overline{\theta}+s_L(8s_H-s_L)t_H-s_H(12s_H-s_L)t_L}{s_L(4s_H-s_L)^2}$. The solution to the first order conditions gives us the following tariffs.

$$t_H = \frac{s_H\left(3s_H - s_L\right)\overline{\theta}}{9s_H - s_L} \tag{10a}$$

$$t_L = \frac{2s_H s_L\overline{\theta}}{9s_H - s_L} \tag{10b}$$

It is easy to see that the tariff on the high quality import is always greater than the tariff on the low quality import. Further, the high quality discriminatory tariff (see [10a]) is always greater than the uniform tariff (see [8]). The discriminatory tariff for the low quality firm (see [10b]) is smaller than the uniform tariff (see [8]).

In the first stage firms maximize profits, $\max_{s_i} \pi_i$, which gives us the following quality reaction functions:

$$s_H = \frac{\left(81s_H^3 - 27s_H^2 s_L + 3s_H s_L^2 - s_L^3\right)\overline{\theta}^2}{\left(9s_H - s_L\right)^3} \tag{11a}$$

$$s_L = \frac{4s_H^2\left(9s_H + s_L\right)\overline{\theta}^2}{\left(9s_H - s_L\right)^3} \tag{11b}$$

The implicit reaction functions [11a] and [11b], can be seen in the *figure 4*. Under the tariff both the reaction functions shift inwards. Given that the import tariff faced by the low quality firm is smaller

its reaction function shifts in by a smaller amount. The opposite is true for the high quality firm. A discriminatory tariffs favors the low quality and works against the high quality firm.

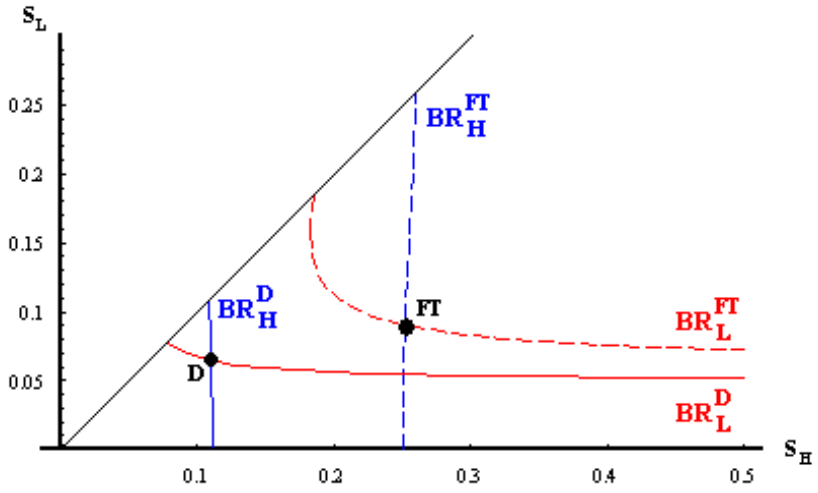

Figure 4: Discriminatory tariffs: Quality reaction functions (for $\overline{\theta} = 1$).

Solving equations [11a] and [11b], and substituting in the price, quantity and profit functions we obtain the equilibrium values (see table **??**).

$s_H^D = 0.110822\overline{\theta}^2$	$s_L^D = 0.064163\overline{\theta}^2$	$q_H^D = 0.287498\overline{\theta}$	$q_L^D = 0.237501\overline{\theta}$
$p_H^D = 0.063722\overline{\theta}^3$	$p_L^D = 0.030477\overline{\theta}^3$	$\Pi_H^D = 0.003019\overline{\theta}^4$	$\Pi_L^D = 0.001561\overline{\theta}^4$

Table 3: Equilibrium values under a discriminatory import tariff.

Quality investment, output and profits decline for both the firms relative to free trade. Compared with a uniform tariff quality, quantity and profits for the high quality firm decline. The low quality firm, however, invests more in quality, sells more and increases its profits. Substituting the optimal qualities [10a] and [10b], we obtain the discriminatory low and high quality tariffs, $t_H^D = 0.031861\overline{\theta}^3$ and $t_L^D = 0.015239\overline{\theta}^3$. Total tariff revenue accruing to the government is $R^D = 0.012779\overline{\theta}^4$. Consumer surplus for the high, and low, quality consumers is $CS_H^D = 0.008961\overline{\theta}^4$ and $CS_L^D = 0.00181\overline{\theta}^4$, respectively. Total welfare under the discriminatory tariff is $TW^D = 0.02355\overline{\theta}^4$.

Proposition 2 *Compared to free trade, $TW^{FT} = 0.040174\overline{\theta}^4$, total welfare under a discriminatory tariff declines, $TW^D = 0.02355\overline{\theta}^4$. Further, total welfare also declines compared to the uniform tariff, $TW^U = 0.032379\overline{\theta}^4$.*

Firms anticipating a discriminatory tariff invest less in quality. Even though tariff revenues increase total welfare declines due to the sharp fall in consumer surplus. A uniform tariff favors the high quality firm while the discriminatory tariff works against the high quality firm. The ability of the government to discriminate in this case works to its detriment and total welfare declines. Of course one needs to keep in mind that with a single instrument the government is targeting both output and quality. Anticipating the

tariff the firm is thus able to strategically respond by lowering its quality thus diminishing the effectiveness of the tariff. The negative effect on quality investment in this case negates the increase in tariff revenues. Again, compared to free trade total output declines.

4 Conclusion

Tariffs based upon quality is widely adopted practice in international trade. In this paper we highlight the impact upon quality investment, a long run variable, of uniform and discriminatory tariffs. Unlike the previously known results for homogenous goods industries (Brander and Spencer (1984)), we show that uniform and discriminatory tariffs decrease the welfare of the importing country. Interestingly, uniform tariff, as a policy instrument, is better for a country than a discriminative tariff.

The effect upon quality investment, however, is different under these two tariffs. Uniform tariffs tend to favor the high quality firm, while discriminatory tariffs favor the low quality firm. Though, in varying degrees, the tariffs affect quality investment by both the firms negatively. A uniform tariff affects quality investment by the low quality firm most while, the discriminative tariff has a (greater) negative impact upon the high quality firm. Further, compared to free trade, total output sold declines under both the tariffs. It is this decrease in quality and output that results in the decline in total welfare.

The decrease in total welfare for an importing country occurs due to the strategic behavior of the exporting firms that, anticipating the tariff, lower their quality investment. The strategic advantage of an import tariff is lost for the government due to its inability to control quality investment. Due to decreased quality investment consumer surplus is lower. This decline is greater than the tariff revenues and hence total welfare (and total output sold) declines. This result is important as it indicates that in models where the government targets more than one instrument (price, or output, combined with quality, or R&D) a simple tariff policy may be welfare decreasing. Our result points out the ineffectiveness of using single instruments in such environments. Further, applying the intuition from models where the quality dimension is ignored can be misleading.

Our results are interesting given that it is common practice that goods with higher qualities are taxed heavily relative to lower quality goods. In this paper we show that there is no economic rationale for such a practice. In fact total welfare in our paper is greater under a uniform, than under the more widely used discriminative, tariff. In this sense our result lends support to the WTO argument for lowering tariff barriers.

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